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ABSTRACT

Presented in this teacher's guide for grades 10-12 are lesson plans and ideas for integrating mathematics and environmental education. Each lesson originates with a fundamental concept pertaining to the environment and states, in addition, its discipline area, subject area, and problem orientation. Following this, behavioral objectives and suggested learning experiences are outlined. Behavioral objectives include cognitive and affective objectives and skills to be learned, while learning experiences list student-centered in-class activities and outside resource and community activities. Space is provided for teachers to note resource and reference materials--publications, audio-visual aids, and community resources. The guides are supplementary in nature and the lessons or episodes are designed to be placed in existing course content at appropriate times. This work was prepared under an ESEA Title III contract for Project I-C-E (Instruction-Curriculum-Environment). (BL)

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Project I - C - E INSTRUCTION - CURRICULUM - ENVIRONMENT

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A SUPPLEMENTARY PROGRAM FOR ENVIRONMENTAL EDUCATION

DISCIPLINE AREA Mathematics GRADE 10-12

Produced under Title III E.S.E.A.
PROJECT I-C-E
Serving Schools in CESA 3-8-9
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EA Mathematics GRADE 10-12

Title III E.S.E.A.

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PREFACE

"Oikus" for house is the Greek origin of the term "ecology". studies our house--whatever or wherever it may be. Like an un expand or contract to fit many ranges--natural and man-made. envirorments, our many "houses" if we omit rancor and cite lon complexities. Our "oikus" uses the insights of all subjects. multidisciplinary program like ours necessarily results. Also a long time, our program ranges K thru 12. The environment mi values. These values have their origin in the "oikus" of our minds. Let us become masters of our house by replacing the G with "Know thyself and thine house."

1. Written and designed by your fellow teachers, this guide is to fit appropriately into existing, logical course content.
2. Each page or episode offers <u>suggestions</u>. Knowing your stud to <u>adapt</u> or <u>adopt</u>. Limitless chances are here for your exp Many episodes are self contained, some open-minded, still o developed over a few days.
3. <u>Try these episodes</u>, but <u>please pre-plan</u>. Why? Simply, no and no curriculum will work unless viewed in the context of
4. <u>React</u> to this guide with scratch ideas and notes on the epi
5. After using an episode, <u>fill out the attached evaluation fo</u> duplicate, or request more of these forms. Send them singl We sincerely want your reactions or suggestions--negative a <u>evaluations are the key</u> in telling us "what works" and in a the guides.

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ICE RMC is <u>Project ICE Resource Materials Center</u> serving all school districts in CESA 3, 8, and 9. Check the Project ICE B resources. Our address and phone number is on this guide's co or call us for any materials or help.

BAVI is Bureau of Audio Visual Instruction, 1327 University A Madison, Wisconsin 53701 (Phone: 608-262-1644).

Cognitive means a measurable mental skill, ability, or proces

Affective refers to student attitudes, values, and feelings.

PREFACE

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ective refers to student attitudes, values, and feelings.

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	Gery Farrell, Menasha	

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT 1. Energy from the sun, the basic source of all energy, is converted through plant photosynthesis into a form all living things can use for life processes.

Discipline Area: Math

Subject: Geometr

Problem Orientation: Man-mad / Natural

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPE	
Cognitive: The student will identify various geometric forms in nature and man-designed structures. Affective: The students will appreciate the organization of natural and man-made geometric forms found in their community. Skills to be Learned Symmetry a. bilateral b. radial Asymmetrical Geometric shapes Identification	I. Student-Centered in class activity A. Review some of the basic geometric forms in class. B. Review the idea of symmetry and asymmetrical in class. 1. Have the students identify various lines of symmetry on geometric figures. C. Have the students bring some small natural objects like a blade of grass, leaves of different trees, flowers, stones and twigs to class to recognize lines of symmetry, if these objects possess any.	II. Outs Commu A. A y e p 1 2 B. C a C. R t t s C t t

rgy from the sun, the basic

of all energy, is converted

h plant photosynthesis into a

ll living things can use for life processes.

Discipline Area Math

Subject Geometry

Problem Orientation Man-made and Natural Forms Grade 10

IOR/L OBJECTIVES	SUGGESTED LEARNING EXPERIENCES	
The student ify various forms in man-designed . The students ciate the on of natural de geometric d in their	I. Student-Centered in class activity A. Review some of the basic geometric forms in class. B. Review the idea of symmetry and asymmetrical in class. 1. Have the students identify various lines of symmetry on geometric figures. C. Have the students bring some small natural objects like a blade of grass, leaves of different trees, flowers, stones and twigs to class to recognize lines of symmetry, if these objects possess any.	II. Outside Resource and Community Activities A. A field trip through your community, especially to a city park. 1. Observe large natural things like trees and clouds. Sketch these observations. 2. Select several buildings and look at it from different points of view. Sketch silhouettes of the buildings. B. Compare the natural and man-made forms. C. Repeat these observations at different times of the year and sketch your observations. Compare your results to various seasons of the year.
be Learned ral al shapes tion		

Resource and Reference Materials	Continued and Additional Suggested Lea
Publications: Geometry text U.S. Dept of Agri., The Community School Site - A Laboratory for Learning, I-C-E RMC Audio-Visual: Investigations in Ecology, I-C-E RMC Grassland Ecology, #3966 BAVI Symmetry, #7882 BAVI Community: City park	

e Materials	Continued and Additional Suggested Learning Experiences
e Community atory for	
ogy, 66 BAVI	

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT: 4. An adequate supply of pure water is essential for life.

Discipline Area: Math

Subject: Geometry

Problem Orientation: Water Tab

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERI	
Cognitive: Students will compile and graph data as a result of previous research and hypothesize the needs of a community. Affective: Students should feel he has made some worthwhile conclusions and recommendations for future conservation or wise use of water.	I. Student-Centered in class activity A. Gather data on water table depths and how they vary during the year. B. Construct graphs using the data collected. C. Hypothesize the future needs of the community based on present demands.	II. Out Comm A. B. C. D.
Skills to be Learned Graphing points Drawing conclusions Assimilate data Interpret information Research Interviews		

ːe supply of pure

ːential for life.

Discipline Area Math

Subject Geometry

Problem Orientation Water Tables Grade 10

ECTIVES	SUGGESTED LEARNING EXPERIENCES	
nts will h data revious othesize ommunity. nts as made conclusions ons for ion or r.	I. Student-Centered in class activity A. Gather data on water table depths and how they vary during the year. B. Construct graphs using the data collected. C. Hypothesize the future needs of the community based on present demands.	II. Outside Resource and Community Activities A. Visit water department of community to secure information from records on water demands at different times of the year. B. Observe well drilling operations. C. Make rain gauges and chart information for several months. D. Go to nearest weather station and get their data to compare with that gathered by the students.
rned		
ons		
ation		

Resource and Reference Materials	Continued and Additional Suggested Learning Exper
140 So Soil Conservation Society of America, Water Use: Principles and Guidelines for Planning and Manage- in Wisconsin, I-C-E RMC	
Audio-Visual: City Water Supply #0433 BAVI Water Supply, #2384 BAVI Water, #3394 BAVI Conserving Our Water Resources Today, #5367 BAVI	
Community:	

Materials	Continued and Additional Suggested Learning Experiences
Society of nciples and and Manage-	
BAVI VI	
sources	

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT

5. An adequate supply of clean air is essential because most organisms depend on oxygen, through respiration, to release the energy in their food.

Discipline Area: Math

Subject: Geomet

Problem Orientation: Facts / Opinio

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EX
Cognitive: The student will write and explain true and false statements using basic ecological facts. Affective: The student will desire to gather more facts on air pollution.	I. Student-Centered in class activity A. Problem 1 Given: 1. The amount of dustfall is larger where the population is more dense, such as large cities. 2. Dustfall is greater during daylight hours because of the number of industries and automobiles in operation. 3. Dustfall is greater on weekdays than on weekends, largely because of industrial activity. 4. Dustfall is two or three times heavier in winter than in summer. The greater dustfall in winter is the result of the burning of coal, oil and other fuels for heat. Statements: 1. A true sample of dustfall will be obtained at night on the weekend in summer. Explain. (cont.)
Skills to be Learned Sentence writing Compound sentences True-false statements	II.

adequate supply of clean air

ential because most organisms

on oxygen, through respiration,

ease the energy in their food.

Discipline Area Math

Subject Geometry

Problem Orientation Facts vs Opinions

Grade 10

ORAL OBJECTIVES	SUGGESTED LEARNING EXPERIENCES	
: The student e and explain false statements ic ecological : The student re to gather s on air . be Learned writing sentences e statements	I. Student-Centered in class activity A. Problem 1 Given: 1. The amount of dustfall is larger where the population is more dense, such as large cities. 2. Dustfall is greater during daylight hours because of the number of industries and automobiles in operation. 3. Dustfall is greater on weekdays than on weekends, largely because of industrial activity. 4. Dustfall is two or three times heavier in winter than in summer. The greater dustfall in winter is the result of the burning of coal, oil and other fuels for heat. Statements: 1. A true sample of dustfall will be obtained at night on the weekend in summer. Explain. (cont.)	II. Outside Resource and Community Activities A. Have the students take a dustfall sample in the industrial area and compare it to a sample from a residential area. B. Discuss the various types of areas that make up a community, check or compare the air pollution in each section. Is there a difference in the air? How much? What statements can be concluded from this experiment?

Resource and Reference Materials	Continued and Additional Suggested Learning Ex
Publications: Air Pollution, Charles Lavaroni & Patrick O'Donnell, Addison-Wesley, 1971 Audio-Visual: Poisoned Air, 50 min. discussion Carousel Films, Inc. 1501 Broadway New York, N.Y. 10035 Air Pollution: Take a Deep Deadly Breath, (3 parts, 54 min., free) National Medical Audio-Visual Center, Chamblee, Ga. 30005 The Runaround, 13 min. (free) Wis. Tuberculosis & Respiratory Disease Assoc. Publication Dept. Box 424 Milwaukee, Wi. 53201 Community: City Health Dept.	I. (cont.) 2. A true sample will be obtained at noo Wednesday in January. Explain Discussion: 1. How would a true or average dustfall for an area? 2. When would the highest sample be obta lowest sample? B. Problem 2 Given: 1. A man can live without water for five can live without food for five weeks can live without air for only five mi 2. To maintain his health, each day the must consume about: a. 4.5 pounds of water b. 2.8 pounds of food c. 30 pounds of air Write three false statements from the ab ecological facts. At least one statemen be a compound sentence. Write three true statements from the abo ecological facts. At least one statemen be a compound sentence.

e Materials	Continued and Additional Suggested Learning Experiences
es Lavaroni , l . discussion 5 a Deep Deadly + min., free) dio-Visual . 30005 . (free) Respiratory cation Dept.)1	I. (cont.) 2. A true sample will be obtained at noon on Wednesday in January. Explain Discussion: 1. How would a true or average dustfall be determined for an area? 2. When would the highest sample be obtained? The lowest sample? B. Problem 2 Given: 1. A man can live without water for five days. He can live without food for five weeks, but he can live without air for only five minutes. 2. To maintain his health, each day the average man must consume about: a. 4.5 pounds of water b. 2.8 pounds of food c. 30 pounds of air Write three false statements from the above given ecological facts. At least one statement should be a compound sentence. Write three true statements from the above given ecological facts. At least one statement should be a compound sentence.

ESEA Title III - 67-70-0135-2 Project I-C-E

CONCEPT	6. Natural resources are not equally distributed over the earth or over time and greatly affect the geographic conditions and quality of life.	Discipline Area ____ Subject ____ Problem Orientation

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNI
Cognitive: Students will be able to list and describe 5 kinds of dams and also 5 reasons for building dams. Affective: Students will appreciate how much study and research goes into building a dam and how the entire ecology can be changed by construction of a dam.	I. Student-Centered in class activity A. Students will study different types of dams and their uses. 1. Masonry dams a. Hollow dams b. Buttress dams c. Multiple arch dams 2. Embankment dams a. Earth-fill b. Semi-hydraulic fill and hydraulic fill c. Rock fill 3. Timber dams 4. Gravity dams 5. Overflow dams B. Students work in small groups and first draw the plans and then construct models of various types of dams. (This could be given as an "A" contract.) If everyone did not participate, a special class could be devoted to explanations of the various drawings or models. C. The instructor should point out various types of geometric constructions used in making d
Skills to be Learned Practical use for geometric constructions Understanding of how geometry and trig. are used in construction Drawing plans according to a scale teaches ratio and proportion	

ral resources are not equally
uted over the earth or over
d greatly affect the geographic
ons and quality of life.

Discipline Area Math

Subject Geometry - Constructions and Trigonometry

Problem Orientation Dams & the Ecology Grade 10

AL OBJECTIVES	SUGGESTED LEARNING EXPERIENCES	
Students will list and kinds of dams reasons for ms. Students will how much research goes ng a dam and ire ecology ged by n of a dam.	I. Student-Centered in class activity A. Students will study different types of dams and their uses. 1. Masonry dams a. Hollow dams b. Buttress dams c. Multiple arch dams 2. Embankment dams a. Earth-fill b. Semi-hydraulic fill and hydraulic fill c. Rock fill 3. Timber dams 4. Gravity dams 5. Overflow dams B. Students work in small groups and first draw the plans and then construct models of various types of dams. (This could be given as an "A" contract.) If everyone did not participate, a special class could be devoted to explanations of the various drawings or models. C. The instructor should point out various types of geometric constructions used in making dams.	II. Outside Resource and Community Activities A. Visit a dam in the vicinity. Find: 1. Cost of construction. 2. How did it change the environment? a. Economically b. Aesthetically 3. Was it necessary to relocate? a. Homes b. Highways c. Utilities 4. What were the advantages to the area? 5. What were the disadvantages? B. When travelling or visiting other areas, the large dams are always a feature of extreme interest. Students should be interested in finding out the reasons for the particular dam. (cont.)

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constructions
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nd trig. are
onstruction
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teaches
proportion

Resource and Reference Materials	Continued and Additional Sugges
Publications: Any encyclopedia Brochures from any of the large dams by writing to the authorized places. Audio-Visual: Dams, #4688 BAVI Community: Visit to a local dam	II. (cont.) 1. Stop flow of water in ri 2. Raise the water level. 3. Stored water produces hy 4. Release at a certain tim all times in certain riv The wildlife, fish, etc. 5. Irrigation to change wor productive land, etc.

ference Materials	Continued and Additional Suggested Learning Experiences
ny of the large to the es.	II. (cont.) 1. Stop flow of water in river or stream. 2. Raise the water level. 3. Stored water produces hydro-electric power. 4. Release at a certain time to assure water at all times in certain rivers which may dry up. The wildlife, fish, etc. can thus be saved. 5. Irrigation to change worthless land into productive land, etc.
I	
dam	

ESEA Title III - 59-70-0135-2 Project I-C-3

CONCEPT 7. Factors such as facilitating transportation, economic conditions, population growth, and increased leisure time have a great influence on changes in land use and centers of population density.

Discipline Area: Math

Subject: Geometry

Problem Orientation: Land Uses

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERIENCE	
Cognitive: Students will construct a map drawn to scale of an area to illustrate what objects are found in that particular area. The maps will be constructed by a method called triangulation. Affective: The students will appreciate the use of maps and how they aid an ecologist in identifying land uses. Skills to be Learned Using a compass Scale drawing Construction of a sextant	I. Student-Centered in class activity A. Review in class: 1. Define what an angle is. 2. Different kinds of angles like acute, obtuse, etc. 3. A protractor, the scale on a protractor and how to read this scale. 4. Review scale drawings and how they are used on different maps, the globe, pictures in books. B. Description of the procedure used in map-making by triangulation. 1. Mark a "base line" with 2 stakes and a string on one side of your area. The distance between the 2 stakes is selected by the individual and it is suggested that the distance represents a length which can easily be converted to scale drawing. Label one stake "A" and the other "B". Attach a string to the top of the 2 stakes as a "base line". Using a protractor (cont.)	II. Outside R Community A. Constr experi descri activi 1. Stu thi yar stu com 2. The can the rur 3. Can con yar sup tea

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d increased

reat influence

e and centers of population density.

Discipline Area Math

Subject Geometry

Problem Orientation Land Uses Grade 10

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity

A. Review in class:

1. Define what an angle is.
2. Different kinds of angles like acute, obtuse, etc.
3. A protractor, the scale on a protractor and how to read this scale.
4. Review scale drawings and how they are used on different maps, the globe, pictures in books.

B. Description of the procedure used in map-making by triangulation.

1. Mark a "base line" with 2 stakes and a string on one side of your area. The distance between the 2 stakes is selected by the individual, and it is suggested that the distance represents a length which can easily be converted to scale drawing. Label one stake "A" and the other "B". Attach a string to the top of the 2 stakes as a "base line". Using a protractor

(cont.)

II. Outside Resource and Community Activities

A. Construct the experiment which was described in class activity, part B.

1. Students can do this in their own yard. Allow the students a week to complete their map.
2. The same experiment can be conducted in the city park, rural areas, etc.
3. Can also be conducted in school yard under the supervision of the teacher.

Resource and Reference Materials	Continued and Additional Suggested Learni
Publications: 110 Un Introducing Measurement, Unit 5, Minnesota Math & Science Teaching Project, I-C-E RMC FM 21-26 Map Reading, Dept. of the Army Field Manual, I-C-E RMC Audio-Visual: Investigations in Ecology, I-C-E RMC Don't Crowd Me, #7628 BAVI Litter Monster, #3978 BAVI Man Uses and Changes the Land, #6889 BAVI Community: Visit to city park	I. (cont.) at stake "A", select an object in the a measure the angle of the object to the Zero on the protractor represents the " (string). Record this angle measure. Go to stake "B" and record the angle object and the "base line". Follow the same procedure with other area that you want to map. Be sure to r angle measurements of objects at the tw A scale drawing of the area can be co using the selected scale and the angle which you obtained. Note: A sextant could be used in place in this episode.

ence Materials	Continued and Additional Suggested Learning Experiences
Measurement, esota Math & ning Project, g, Dept. of ld Manual, cology, 28 BAVI 78 BAVI s the Land,	I. (cont.) at stake "A", select an object in the area and measure the angle of the object to the "base line". Zero on the protractor represents the "base line" (string). Record this angle measure. Go to stake "B" and record the angle from the same object and the "base line". Follow the same procedure with other objects in the area that you want to map. Be sure to record the angle measurements of objects at the two stakes. A scale drawing of the area can be constructed by using the selected scale and the angle readings which you obtained. Note: A sextant could be used in place of a compass in this episode.

CONCEPT 8. Cultural, economic, social and political factors determine status of man's values and attitudes toward his environment.

Discipline Area: Math

Subject: Geometry

Problem Orientation: An economi factor

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERIENC
Cognitive: The student will use coordinate geometry to determine points or positions in two dimensions. Affective: The student should appreciate that locating positions can be conducted on a small scale, like locating a point or on a large scale like describing a position of a star. Skills to be Learned 1. Locating points (graphing) 2. Using positive and negative integers	I. Student-Centered in class activity A. Class review: 1. Define a point and plane 2. On a plane, draw the horizontal line or x-axis and a vertical line which is the y-axis. Review the idea of positive and negative integers in reference to the two axes. Select two integers and plot this point on paper (graph paper preferred) in reference to the two axes. NOTE I: The two axes intersect at a point called the origin. NOTE II: The two numbers selected are called ordered pairs B. Plot the following ordered pairs on graph paper and connect the points in order. 1. (-4,-5) 6. (0,-6) 2. (-3.4,-5.5) 7. (2,-6) 3. (-3,-5.8) 8. (2.5,-5.9) 4. (-2.5,-5.9) 9. (3,-5.8) 5. (-2,-6) 10. (3.5,-5.5) (cont.

omic, social and

determine status

d attitudes

ment.

Discipline Area Math

Subject Geometry

Problem Orientation An economic factor Grade 10

ES	SUGGESTED LEARNING EXPERIENCES	
ent will try to positions ent should ting positions a small scale, t or on a cribing a graphing) d negative	I. Student-Centered in class activity A. Class review: 1. Define a point and plane 2. On a plane, draw the horizontal line or x-axis and a vertical line which is the y-axis. Review the idea of positive and negative integers in reference to the two axes. Select two integers and plot this point on paper (graph paper preferred) in reference to the two axes. NOTE I: The two axes intersect at a point called the origin. NOTE II: The two numbers selected are called ordered pairs B. Plot the following ordered pairs on graph paper and connect the points in order. 1. (-4,-5) 6. (0,-6) 2. (-3.4,-5.5) 7. (2,-6) 3. (-3,-5.8) 8. (2.5,-5.9) 4. (-2.5,-5.9) 9. (3,-5.8) 5. (-2,-6) 10. (3.5,-5.5) (cont.	II. Outside Resource and Community Activities A. Take a field trip to the sanitary landfill in your community. Discuss the effect of recycling for the items observed in the landfill site. (The relationship of the idea with the student activity is that the answer for Part B is a can.) B. The city's sanitation engineer can give a talk to the class on the landfill sites in the area, recycling in the community and other related topics.

Resource and Reference Materials

Publications:

Pollution: Problems, Projects and Mathematical Exercise, Wisconsin Department of Public Instruction

Audio-Visual:

Film #0822 - "Geometry in Action"-($2.00)-BAVI-1940

Film #7251-7252 - "What Are We Doing to Our World?"-($21.00)-BAVI-1970

Community:

Sanitation engineer for your community

Visit to community landfill site

Continued and Additional Suggested

I. (cont.)

11. (4,-5)
12. (4,0)
13. (4,6)
14. (3.5,6.5)
15. (3,6.8)
16. (2.5,6.9)
17. (2,7)
18. (0,7)
19. (-2,7)
20. (-2.5,6.9)
21. (-3,6.8)
22. (-3
23. (-4
24. (-3
25. (-3
26. (-2
27. (-2
28. (2,
29. (2.
30. (3,
31. (3.
32. (4,

Connect (-4,6) to (-4,-5)
What polluting article does thi

NOTE: The information presente taken from page 48 in th Pollution.

Materials	Continued and Additional Suggested Learning Experiences
ects and sconsin ruction	I. (cont.) 11. (4,-5) 12. (4,0) 13. (4,6) 14. (3.5,6.5) 15. (3,6.8) 16. (2.5,6.9) 17. (2,7) 18. (0,7) 19. (-2,7) 20. (-2.5,6.9) 21. (-3,6.8) 22. (-3.5,6.5) 23. (-4,6) 24. (-3.5,5.5) 25. (-3,5.2) 26. (-2.5,5.1) 27. (-2,5) 28. (2,5) 29. (2.5,5.1) 30. (3,5.2) 31. (3.5,5.5) 32. (4,6) Connect (-4,6) to (-4,-5) What polluting article does this represent?
ction"-	
We Doing /I-1970	NOTE: The information presented in this chart was taken from page 48 in the book entitled Pollution.
r community site	

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT: 9. Man has the ability to manage, manipulate, and change his environment.

Discipline Area: Mat

Subject: Geo

Problem Orientation: W

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING	II. O Co
Cognitive: Using research methods, students will find out various ways in which water sheds, are managed and used to change man's environment. Affective: Students should advocate or reject man's use of water, shed management for his immediate and material gains Skills to be Learned 1. Research at the library 2. Reporting 3. Critical reading 4. Evaluation 5. Problem solving	I. Student-Centered in class activity A. List as many ways as possible of man's use of water shed control. 1. Use library 2. Report on different programs 3. Evaluate the worth of existing programs 4. Discuss pros and cons (Buzz groups) B. Construct drawings using geometric designs of water shed management areas, showing use of land. C. Geometric proofs can be employed by setting up axioms about water and water pollution. Statements that can then be proven will be theorems. Mathematical theorems typically are expressed in the form "if a certain thing is true, then something else is true." In other words, most theorems are "if P, then A" statements. Deductive reasoning can thus be used to solve (cont.)	A. B. C.

y to manage,

his

Discipline Area Math

Subject Geometry

Problem Orientation Water Sheds and Water Conservation Grade 10

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity

A. List as many ways as possible of man's use of water shed control.
   1. Use library
   2. Report on different programs
   3. Evaluate the worth of existing programs
   4. Discuss pros and cons (Buzz groups)

B. Construct drawings using geometric designs of water shed management areas, showing use of land.

C. Geometric proofs can be employed by setting up axioms about water and water pollution. Statements that can then be proven will be theorems. Mathematical theorems typically are expressed in the form "if a certain thing is true, then something else is true." In other words, most theorems are "if P, then A" statements. Deductive reasoning can thus be used to solve (cont.)

II. Outside Resource and Community Activities

A. Take field trips to several water shed areas.

B. Check with nearest university officials to see what is being done in the area.

C. Invite resource people from water control units or from university

Resource and Reference Materials	Continued and Additional Suggested Lea
Publications: 520 Od Fundamentals of Ecology, I-C-E RMC VF Environmental Management, Course Concept and Organization I-C-E RMC Audio-Visual: Film 200 One Day at the Teton Marsh, I-C-E RMC Film: River Systems and Man EAVI, 16 min. $2.00 Community:	I. (cont.) problems. Use Ecolab Rural Studi 1. Measure a quadrat of land - o 2. Make a Line Transect. 3. Make a Belt Transect. 4. Make a graph to show number o found in a quadrat of the fore 5. Walk along a line transect in identify each tree that lies

Continued and Additional Suggested Learning Experiences

I. (cont.)

problems. Use Ecolab Rural Studies.

1. Measure a quadrat of land - one acre.
2. Make a Line Transect.
3. Make a Belt Transect.
4. Make a graph to show number of each kind of tree found in a quadrat of the forest.
5. Walk along a line transect in the forest and identify each tree that lies on it.

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT: 11. Individual acts, duplicated or compounded, produce significant environmental alterations over time.

Discipline Area: Math

Subject: Geom / Env

Problem Orientation: Ch

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EX	II. Outs Commu
Cognitive: The student will identify various geometric designes (circle, square, triangle and rectangle) and "environmental designs" (a house, a room, a city, etc) are very useful to man Affective: The student should recognize and appreciate that different shapes, textures, and colors are used to produce painting, drawings and sculpture. Skills to be Learned 1. Construction 2. Measurement 3. Identification 4. Comparison	I. Student-Centered in class activity A. Each student will construct two squares with two inch sides, one circle with a two inch diameter, one circle with a three inch diamenter, an equilateral triangle with two inch sides and a rectangle with a dimension of two inches by four inches from different color construction paper. 1. Use these geometric figures to form an interesting design and sketch this on a sheet of paper. 2. Make another design and sketch this on another sheet of paper. B. Take each shape and label the squares as chairs, the small circle as a lamp, the large circle a table, the triangle as a television and the rectangle as a sofa. (cont.)	A. Ob li ar su th B. Ob C. Ta sc er in of pa et D. Or di in ar al E. Ha in gi ge ti

acts, duplicated

produce significant

lterations over time.

Discipline Area Math

Subject Geometry

Problem Orientation Environmental Changes Grade 10

CTIVES	SUGGESTED LEARNING EXPERIENCES	
udent ous (circle, nd rec- onmental a room, ery use- udent nd fferent and pro- wings ned	I. Student-Centered in class activity A. Each student will construct two squares with two inch sides, one circle with a two inch diameter, one circle with a three inch diamenter, an equilateral triangle with two inch sides and a rectangle with a dimension of two inches by four inches from different color construction paper 1. Use these geometric figures to form an interesting design and sketch this on a sheet of paper. 2. Make another design and sketch this on another sheet of paper. B. Take each shape and label the squares as chairs, the small circle as a lamp, the large circle a table, the triangle as a television and the rectangle as a sofa. (cont.)	II. Outside Resource and Community Activities A. Obtain an art book from the library to observe geometric and "environmental" designs such as a plan of a cathedral, the design of a city.... B. Obtain a book on architecture. C. Take a field trip through the school to identify various environmental designs found in the building like the color of brick, stone or wood, the patterns of windows and doors, etc. D. On the way home, observe different patterns of buildings, how they are grouped and how their design tells us about their use. E. Have the industrial arts instructor come to class and give a talk on the use of geometric designs in construction.

Resource and Reference Materials	Continued and Additional Suggested Lear
Publications: Curriculum Working Paper, Art Life and the Environment, E. Corso, University of Wisconsin, 1969 Architecture, Drafting and Design, D. Hepler and P. Wallach, Mc-Graw-Hill, 1965 Audio-Visual: Film #7880 - "Ark" ($9.00)-BAVI, 1971 Film #7922 - "Green Box" ($6.75)-BAVI, 1971 Film Junk Dump, I-C-E RMC Film #2996 - "Man's Impact on His Environment" ($7.50) - BAVI, 1969 Community: The city library An architect A building contractor	I.B. cont. 1. Arrange these "items of furniture to you. Sketch on a piece of pap 2. Rearrange the items of furniture on another piece of paper. C. Compare the geometric design and "e on the four sheets of paper. Think the shapes where you did in each ca real difference between the two kin

erials	Continued and Additional Suggested Learning Experiences
rt Life o, 9 esign, -Graw- AVI, 1971 .75)- n His VI, 1969	I.B. cont. 1. Arrange these "items of furniture" which is acceptable to you. Sketch on a piece of paper. 2. Rearrange the items of furniture and sketch this design on another piece of paper. C. Compare the geometric design and "environmental" design on the four sheets of paper. Think about why you placed the shapes where you did in each case. The why is the real difference between the two kinds of designs.

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT 12: Private ownership must be regarded as a stewardship and should not encroach upon or violate the individual right of others.

Discipline Area: Math

Subject: Geometry

Problem Orientation: Pollutio / Angle Me

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERI	
Cognitive: The student will construct and measure angles and solve theorems and axioms. Affective: The student investigates possible ways to show respect for private ownership. Skills to be Learned 1. Measurement of angles 2. Basic properties of angles	I. Student-Centered in class activity A. Define the terms: Angle Vertex Planes Half-planes Interior & exterior of an angle Rays B. Draw constructions in notebooks C. Use protractor to measure angles D. Discuss the difference between acute, right and obtuse angles. How are they different and how are they similar E. Prove theorem: If one of the four angles formed by two intersecting lines is a right angle, then all of the four angles are right angles. Can be done on school grounds or any open area. Measure angles where two roads cross or two fences. Check this out on some neighboring property lines.	II. Outside Communit A. Inter their on th pollu Strea pollu make B. Take and m diffe C. Use a can m D. Map o to co pollu

_____ Discipline Area Math

hould___ Subject Geometry

Pollution

_____ Problem Orientation Angle Measurement Grade 10

rs._____

SUGGESTED LEARNING EXPERIENCES

tudent-Centered in class
tivity

Define the terms:
Angle
Vertex
Planes
Half-planes
Interior & exterior of an angle
Rays
Draw constructions in notebooks
Use protractor to measure angles
Discuss the difference between acute, right and obtuse angles. How are they different and how are they similar
Prove theorem: If one of the four angles formed by two intersecting lines is a right angle, then all of the four angles are right angles.
Can be done on school grounds or any open area. Measure angles where two roads cross or two fences. Check this out on some neighboring property lines.

II. Outside Resource and Community Activities

A. Interview property owners on their views as to their rights on their land. (Ask) Can we pollute the land we live on? Streams? Take pictures of pollution in the community and make a bulletin board collage.
B. Take a field trip to farm area and measure off areas using different angles.
C. Use a sextant which students can make to measure angles
D. Map out areas along roadways to compare for amount of pollution

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT 1. Energy from the sun, the basic source of all energy, is converted through plant photosynthesis into a form all living things can use for life processes.

Discipline Area Mathema

Subject Advance

Problem Orientation Word Fo

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERIENC	
Cognitive: To identify 5 important benefits received from the sun for our environment. Affective: To realize and appreciate the vital functions of the sun. Skills to be Learned: Formula Computation	II. Student-Centered in class Activity A. Calculate the power produced by the sun thru thermonuclear reaction. (54,000 amps per reacton - 126,000,000,000,000) B. Determine the percent of energy received by the sun side of the planet Earth. i/2Bi (Surface area formulas) C. Evaluate the ways the sun's energy can be stored for later use. (i.e., fossil fuels) D. Demonstrate how 23° tilt diminishes the sun's effect on the environment, causing seasons.	II. A B C

y from the sun, the basic source
nergy, is converted through plant
thesis into a form all living things
for life processes.

Discipline Area Mathematics

Subject Advanced Algebra

Problem Orientation Word Problems Grade 11-12
Formulas

L OBJECTIVES	SUGGESTED LEARNING EXPERIENCES	
To identify 5 benefits received from r our environment. To realize and ap- he vital functions of	II. Student-Centered in class Activity A. Calculate the power produced by the sun thru thermonuclear reaction. (54,000 amps per reacton - 126,000,000,000,000) B. Determine the percent of energy received by the sun side of the planet Earth. 1/2Bi (Surface area formulas) C. Evaluate the ways the sun's energy can be stored for later use. (i.e., fossil fuels) D. Demonstrate how 23° tilt diminishes the sun's effect on the environment, causing seasons.	II. Outside Resource and Community Activities A. Visit the U.S. Weather Bureau. Have a meteorologist explain the sun's influence on weather patterns. B. Visit the telephone company for an explanation of the operation and use of photo-electric cells. C. Measure the amount of sunlight lost to the earth's surface by smog and air pollution.
be Learned: mputation		

Resource and Reference Materials	Continued and Additional Suggeste
Publications:	
Audio-Visual:	
Community:	

ference Materials	Continued and Additional Suggested Learning Experiences

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT: 2. All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem.

Discipline Area Mather

Subject Trig. (Fibonacc

Problem Orientation Math In

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EX
Cognitive: Students should make a list of 5 things in nature which illustrate the Fibonacci Sequence, Fibonacci Fractions, or Geometric Shapes . Affective: Students will appreciate the beauty of mathematics in nature. They will be made aware of the simple plants and flowers in nature and, at the same time, appreciate their mathematical pattern.	I. Student-Centered in class Activity A. Students study the units of sequence and series. B. As a special topic or math club project, they study some special sequences that are interesting because of their recreational value and relationship to nature. C. Study these series in relation to the field trip.
Skills to be Learned: Fibonacci Sequence Sequence of Fibonacci Fractions	

nisms interact

s and their

rming an intri-

d an ecosystem.

Discipline Area Mathematics

Subject Trig. (Fibonacci Sequence)

Problem Orientation Mathematical Patterns In Nature Grade 11-12

LS	SUGGESTED LEARNING EXPERIENCES	
should ngs in ate the Fibon- eometric s will y of math- They will simple n nature e, apprec- cal pat-	I. Student-Centered in class Activity A. Students study the units of sequence and series. B. As a special topic or math club project, they study some special sequences that are interesting because of their recreational value and relationship to nature. C. Study these series in relation to the field trip.	II. Outside Resource and Community Activities A. A field trip in the woods or park will help students to enjoy nature and try to preserve it. B. Some of the things they should be able to find Fibonacci patterns in are: daisies, the way leaves grow on many stems, scales on a fir cone, etc. C. They could also look for other geometric shapes in nature. The seeds in a sunflower are arranged in a pattern formed by spirals winding from its center. The honeycomb built by bees contains hexagonal cells in which the bees store the honey. D. A study of series will be done at the same time.
: i Frac-		

Resource and Reference Materials	Continued and Additional Suggested Learning
Publications: Mathematics Books The Giant Golden Book of Mathematics World of Mathematics, Volume 1, pp. 718-719 Audio-Vidual: Community:	

	Continued and Additional Suggested Learning Experiences

ESEA Title III -59-70-0135-2 Project I-C-E

CONCEPT

3. Environmental factors are limiting on the numbers of organisms living within their influence, thus, each environment has a carrying capacity.

Discipline Area Mathematic

Subject Consumer E

Problem Orientation Utiliti

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERIENCES
Cognitive: Students will study the use of and demand for our natural resources versus the supply available. They will also compare this use and demand with earlier ages. Affective: Students should realize that as "Super-Consumers", we must judiciously use our natural resources.	I. Student-Centered in class Activity A. Study the devices man needs to operate at his present standard of living: 1. List the household items that use water power, natural gas or other natural resources. (i.e., dishwasher, washing machine, electric lights, etc.) 2. List the natural resources needed by man outside the house. (i.e., to run his auto, at work, etc.) 3. How does this list compare with 1930, 1890, 1850? 4. The comparisons above should be made by statistical analysis. B. Study Industrial demand on our natural resources.
Skills to be Learned: Public Knowledge of Power Production Statistical Analysis	II. Ou Co A. V C 1. pc B. I pr pc C. S lu ea D. W E. W fu 1. po (cont

ors are limiting

organisms living

ence, thus, each

carrying capacity.

Discipline Area Mathematics

Subject Consumer Math

Problem Orientation Utilities Grade 11-12

	SUGGESTED LEARNING EXPERIENCES	
l study for our is the will also mand with	I. Student-Centered in class Activity A. Study the devices man needs to operate at his present standard of living: 1. List the household items that use water power, natural gas or other natural resources. (i.e., dishwasher, washing machine, electric lights, etc.) 2. List the natural resources needed by man outside the house. (i.e., to run his auto, at work, etc.) 3. How does this list compare with 1930, 1890, 1850? 4. The comparisons above should be made by statistical analysis. B. Study Industrial demand on our natural resources.	II. Outside Resource and Community Activities A. Visit an electric utility Company. 1. Have methods of producing power explained: a. Hydroelectric b. Fossil Fuel c. Nuclear Power B. Learn of distribution problems for the three power producers above. C. Study the individual pollution problem created by each method. D. Where is each used? E. Which method is fit for the future? 1. What source of public power can we continue to use?
hould -Consumers", e our		
wer		

(continued on reverse side)

Resource and Reference Materials

Publications:

Mishan, E. J., Technology and Growth - The Price We Pay, Praeger, 1969

Bernstein, Peter, The Price of Prosperity, Random, 1966

Mumford, Lewis, The Myth of the Machine, Harcourt Brace Jovanovich, 1970

Abrahamson, Dean, Environmental Costs of Electric Power, Scientists Institute for Public Research, 30 E. 68th Street, N.Y., N.Y., 1970.

Audio-Visual:

#1756 - Principles of Electricity, color, $3.50, 22 minutes, GE, 1945, no advertising, B.A.V.I.

#0156 - Atomic Energy, 10 minutes, $2, EBF, 1947, B.A.V.I.

#6378 - Atomic Power Production, 13 minutes, $5, color, Handel, 1964, B.A.V.I.

Community:

Power Plant -- Engineer

(continued on right hand side)

Continued and Additional Suggested

II. (continued)

E.

2. What sources of power remain, gas and radioactive materials

Community: (continued)

National Environmental Organization, Resources for the future, Inc. 1755 Massachusetts, Ave., N.W. Washington, D.C. 20036

Citizen Natural Resources Associatio c/o Carla Kruse, Hickory Hill Farm Loganville, Wisconsin 53943

ials	Continued and Additional Suggested Learning Experiences
	II. (continued) E. 2. What sources of power remain, with coal, natural gas and radioactive materials in limited supply?
er,	
	Community: (continued)
ch,	National Environmental Organization, write to: Resources for the future, Inc. 1755 Massachusetts, Ave., N.W. Washington, D.C. 20036
sts 0 .	Citizen Natural Resources Association c/o Carla Kruse, Hickory Hill Farm Loganville, Wisconsin 53943
y, 45,	
s,	
064,	

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT 3. Environmental factors are limiting on the numbers of organisms living within their influence, thus, each environment has a carrying capacity.

Discipline Area Mathe

Subject Advan

Problem Orientation Ari

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERIEN
Cognitive: The student will list the demands made on our earth by a single person during his lifetime. Affective: The student will suggest ways to reduce the tendency to waste certain natural resources.	I. Student-Centered in class Activity A. Estimate and total the amount of natural resources needed by a single individual throughout his lifetime. (i.e. Human Drain) Specific research for better students. Some Lifetime Statistics Samples follow for instructors use: 3,000,000 gal. Water 20,000 gal. Gasoline 46 tons Garbage (6 lb/day) B. Expand this total to the population of your family, community, state or nation. C. Problems: 1. Examine projected remaining supply of coal (400 years), natural gas (13 years), oil (continued on reverse side)
Skills to be Learned: Summation of an arithmetic progression Decimal Multiplication Gathering Data	

II.

tors are limiting

ganisms living

ce, thus, each

rrying capacity.

Discipline Area Mathematics

Subject Advanced Algebra

Problem Orientation Arithmetic Progression Grade 11-12

S	SUGGESTED LEARNING EXPERIENCES	
will list earth by is life-	I. Student-Centered in class Activity	II. Outside Resource and Community Activities
will sug- tendency resour-	A. Estimate and total the amount of natural resources needed by a single individual throughout his lifetime. (i.e. Human Drain) Specific research for better students. Some Lifetime Statistics Samples follow for instructors use: 3,000,000 gal. Water 20,000 gal. Gasoline 46 tons Garbage (6 lb/day)	A. Visit a grocery store to find out how much food is sold each week. (per capita)
tic	B. Expand this total to the population of your family, community, state or nation.	B. Compare the sales of returnable bottles with non-returnable containers now with those in 1969.
	C. Problems: 1. Examine projected remaining supply of coal (400 years), natural gas (13 years), oil	C. Visit community incinerator or sanitary landfill to quantify the refuse discarded each week.

(continued on reverse side)

Resource and Reference Materials	Continued and Additional Suggested Le
Publications: Mishan, E.J., Technology and Growth - The Price We Pay, Praeger, 1969 Toynbee, Arnold, Change and Habit, Oxford University Press 1966 Marine, Gene, America the Raped, Simon and Schuster, 1969 Audio-Visual: #7614 - Minerals Challenge, color, $2, 1970, 30 minutes B.A.V.I. #7624 - Problems of Conservation: Minerals, color, $6.75, 1969, 16 minutes, B.A.V.I. #0468 - Conservation Road: Story of Our Natural Resources, $3.50, 1947, 20 minutes Community: DNR office Grocery Store Sanitary System Landfill Area	I. (continued) 1. (30 years), Uranium (3 (___) as energy sourc 2. Examine supply of mine production: Steel (35 years), Tin (30 years) and Zinc (20 years) 3. Americans are "Super C 50 times as much natur veloped nations (i.e., 6% of the world popula energy.

inued and Additional Suggested Learning Experiences

I. (continued)

1. (30 years), Uranium (35 years), electricity (___) as energy sources.

2. Examine supply of minerals for industrial production: Steel (350 years), Copper (35 years), Tin (30 years), Lead (25 years), and Zinc (20 years)

3. Americans are "Super Consumers". They use 50 times as much natural resources as undeveloped nations (i.e., India). Therefore, 6% of the world population uses 30% of its energy.

ESEA Title III-59-70-0135-2 Project I-C-P

CONCEPT: 4. An adequate supply of pure water is essential for life.

Discipline Area: Mathem

Subject: Consum

Problem Orientation: W

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERIEN	
Cognitive: Students will tabulate the amount of water used per person/per day. Affective: The students will appreciate the value of water as a natural resource.	I. Student-Centered in class Activity A. Each student will determine the amount of water used by his family by reading the water meter each morning in his home. 1. Each student will keep a daily record of water used by his family. 2. Compare this with the established norm of 60 gallons per person/per day. B. Sample Problem: An imaginary stream is 400 feet wide and 15 feet deep. It has an average velocity of 2 miles per hour. If there are 7.48 gallons of water per cubic foot; 1. How many gallons of water in its flow each hour? 2. How many gallons each day? 3. How long would it take to consume all the river's water--given our town's Pop. and daily consumption rate.	II. A (co
Skills to be Learned: Data Collecting Data Analysis Problem Solving Water Meter Reading		

re

ife.

Discipline Area Mathematics

Subject Consumer Math

Problem Orientation Water Supply Grade 11-12

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class Activity

A. Each student will determine the amount of water used by his family by reading the water meter each morning in his home.

1. Each student will keep a daily record of water used by his family.
2. Compare this with the established norm of 60 gallons per person/per day.

B. Sample Problem: An imaginary stream is 400 feet wide and 15 feet deep. It has an average velocity of 2 miles per hour. If there are 7.48 gallons of water per cubic foot;

1. How many gallons of water in its flow each hour?
2. How many gallons each day?
3. How long would it take to consume all the river's water--given our town's Pop. and daily consumption rate.

II. Outside Resource and Community Activities

A. Civic

1. Read water meter in home daily.
2. Visit a water treatment plant.
3. Find out which cities and towns contribute pollution to local waters.
4. Check to see if each city provides adequate waste treatment.
5. Do existing facilities measure up to present pollution loads?
6. From data gathered, figure out cost of cleaning polluted water.
7. Does local plant operate 24 hours a day? 365 days a year?
8. If plant claims 90% Efficiency, how many times a year is that percentage reached?

(continued on reverse side)

Resource and Reference Materials

Publications:

National Council for Air and Stream Improvement, 103 Park Ave., N.Y., N.Y. 10026

American Public Health Association 1704 Broadway, N.Y., N.Y. 10019

American Institute of Plant Engineers Industrial Pollution Committee, 1056 Delta Ave., Cincinnati, Ohio, 45208

Water Pollution Control Federation 3900 Wisconsin Ave.,N.W., Washington, D.C. 20016

Department of Interior -- Water Pollution, Washington, D.C. 20240

Water in Industry - A Survey of Water Use in Industry, National Association of Manufacturers and Chamber of Commerce of U.S., $2, January 1965

Clean Water - It's up to You, free booklet, Izaak Walton League of America, 1326 Waukegan Road, Glenview, Illinois 60025

Audio-Visual:

What Are We Doing To Our World? Part I (25 minutes) and Part II (27 minutes), $16 each for rental

(continued on right side)

Continued and Additional Suggested L

II. (continued)
B. Industry

1. If treatment is inadequate, wi taking to increase its facili
2. What will be the cost to impro will be paying the added cost?

C. Write to the*Federal Water Pollu for guidelines of pollution cont

D. Check your local industries and if they compare favorably.

E. Begin family campaigns to minimi

1. Check ball float on lavatory,
2. Dripping faucet should be che
3. Keep cold drinking water in r
4. Avoid running tap water unnece
5. Use saver on washing machine.
6. Have students find other ways

F. Evaluate the inconvenience of wat
G. Compare consumption of water in U other countries.
H. Find out where the water from dow go. If they are hooked up to the dinary rainy day will increase th from your house by 300% or more.

*3900 Wisconsin Ave., Washington, D.C.

Community:

Kimberly Clark: Publications and Pamp office. The New River, 16mm. sound c Public Relations Dept., Neenah

Continued and Additional Suggested Learning Experiences

II. (continued)
B. Industry

1. If treatment is inadequate, what steps is industry taking to increase its facilities?
2. What will be the cost to improve facilities? Who will be paying the added cost?

C. Write to the*Federal Water Pollution Control Administration for guidelines of pollution control.

D. Check your local industries and city water supply to see if they compare favorably.

E. Begin family campaigns to minimize water consumption:

1. Check ball float on lavatory,
2. Dripping faucet should be checked and fixed if faulty.
3. Keep cold drinking water in refrigerator.
4. Avoid running tap water unnecessarily.
5. Use saver on washing machine.
6. Have students find other ways to save water.

F. Evaluate the inconvenience of water saving.
G. Compare consumption of water in U.S. with consumption in other countries.
H. Find out where the water from down spouts and drain tiles go. If they are hooked up to the municipal sewer, an ordinary rainy day will increase the flow in the sewer line from your house by 300% or more.

*3900 Wisconsin Ave., Washington, D.C.

Community:

Kimberly Clark: Publications and Pamphlets available at Main office. The New River; 16mm. sound color film available from Public Relations Dept., Neenah

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT: 4. An adequate supply of pure water is essential for life

Discipline Area: Math

Subject: Advanced Dis

Problem Orientation:

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPE	
Cognitive: Students will list the difficuties of the public water system. Affective: Students will put water on the top pedestal as our greatest natural resource. Skills to be Learned 1. Data analysis 2. Channelization of H_2O. 3. Evaluation of economic compromization (cost of improving facilities as compared to benefits derived)	I. Student-Centered in class activity A. Examine the water needs of man (STIX: 150 gal./ person pumped-actual fact) 1. 60 gal. personal use 2. 20 gal. commercial use 3. 10 gal. distribution losses 4. 50 gal. industrial uses 5. 10 gal. livestock How much water does your class use each day? the families of the class? B. Calculate the cost of obtaining, treating, distributing, disposing, retreating and repurifying this water. C. Extrapolate the impact by comparing it to the entire population of a community D. Students should: 1. Study distillation 2. Study electrolysis 3. Understand how water is unique in its recycling process. (cont.)	II. Outsi Commun A. Vis 1. 2. 3. B. Vis see for

y of pure

r life

Discipline Area Math

Subject Advanced Algebra

Problem Orientation Distributive Law Grade 11-12

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity
- A. Examine the water needs of man (STIX: 150 gal./ person pumped-actual fact)
  1. 60 gal. personal use
  2. 20 gal. commercial use
  3. 10 gal. distribution losses
  4. 50 gal. industrial uses
  5. 10 gal. livestock

  How much water does your class use each day? the families of the class?
- B. Calculate the cost of obtaining, treating, distributing, disposing, retreating and repurifying this water.
- C. Extrapolate the impact by comparing it to the entire population of a community
- D. Students should:
  1. Study distillation
  2. Study electrolysis
  3. Understand how water is unique in its recycling process.

(cont.)

II. Outside Resource and Community Activities
- A. Visit a water department
  1. Explain the problems of obtaining high quality water
  2. Explain mineral content problems
  3. Examine destruction problems
     a. Hardness
     b. Frost
     c. Expansion contraction
     d. Pumping and pressure
- B. Visit the street department to see the maintenance required for the distribution system.

Resource and Reference Materials

Publications:

140 Soil Conservation Society of SO America, 1969, Water Use: Principles and Guidelines for Planning and Management in Wisconsin, I-C-E RMC

VF U.S. Dept. of the Interior, 1969, A Primer on Waste Water Treatment, Federal Water Pollution Control Administration, I-C-E RMC

VF U.S. Dept. of the Interior, 1970, Clean Water-It's Up To You, Federal Water Quality Admin. I-C-E

VF What You Can Do About Water Pollution, Office of Public Information, Federal Water Quality Admin., I-C-E RMC

Audio-Visual:

#6141-"Every Drop Fit to Drink," color, $2.00, 15 min., 1965, BAVI

#6923-"3rd Pollution," color, 22 min., $7.50, 1966, BAVI

#2903-"The Waters Around Us," 22 min., $2.00, I-C-E RMC

#280-"The Gifts," color, I-C-E, RMC

Simulation Game: SG3 - 1970, Dirty Water: The Water Pollution Game, I-C-E RMC

Community:

Industrial water chemists

Science teacher

Continued and Additional Suggested Le

I. (cont.)

4. Discover what pollutants are eas to remove
5. Compare methods of water purific sedimentation.

s	Continued and Additional Suggested Learning Experiences
r	I. (cont.) 4. Discover what pollutants are easy and which are difficult to remove 5. Compare methods of water purification filterization vs. sedimentation.
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ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT 5. An adequate supply of clean air is essential because most organisms depend on oxygen, through respiration, to release the energy in their food.

Discipline Area Math

Subject Problem Sol

Problem Orientation Air Poll

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPER	
Cognitive: The student will list the sources of air pollution and the cost of control of these pollutants in their community. Affective: The student will weigh the cost of pollution control against environmental costs resulting from pollution damage. Skills to be Learned Problem Solving Cost analysis Data gathering	I. Student-Centered in class activity A. Students will list the major air pollutants and the hazards of various pollutants. (Research) 1. City 2. National B. Check into the various control measures and the cost of these measures. 1. Compare these costs to the problems in their city, state, nation. C. In relation to human health, personal property, vegetation and other materials, what is the cost to maintain, repair or replace, due to air pollutants? D. Sample problem: 1. Aggravated by air pollutants, emphysema is the fastest growing cause of death in our country today. In the ten-year period, 1950-1959, deaths among males (cont.)	II. Ou Com A. B. C.

line Area Math

t Problem Solving

m Orientation Air Pollution Grade 11-12

SUGGESTED LEARNING EXPERIENCES

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period, 1950-
eaths among males
(cont.)

II. Outside Resource and Community Activities

A. Visit local industries to check what measures they are taking relative to air pollution control.
   1. What is the cost of the control measures?
   2. Determine the problems in control level of air pollution.

B. Interview medical personnel.
   1. What pollutants are most injurious to our health?
   2. What are the amounts of pollutants and the cost involved (medically)?

C. Check with city authorities about their air pollution regulations.

Resource and Reference Materials	Continued and Additional Sugge
Publications: Appleton Post Crescent, Sunday Feb. 27, 1972, Section F, p. 1. In Quest of Cleaner Air & Water, I-C-E RMC Audio-Visual: The Poisoned Air, 50 min., color, National Medical AV Center Chamblee, Ga. 30005 Air Pollution - A Series WOR-TV 1440 Broadway New York, N.Y. 10018 Simulation Game: Smog: The Air Pollution Game I-C-E RMC Community: Library City Hall Health Dept. Transportation Dept. Industrial Management Comm. Local industries	I. (cont.) from emphysema rose from to 8 per hundred thousan steadily increased, in 1 U.S. was 203 million and emphysema, how many peop died from emphysema? Wha made for 1980? E. Have the students take t gathered in the class an make up some problems. 1. Give the problems to class to work on.

Continued and Additional Suggested Learning Experiences

I. (cont.)

from emphysema rose from 1.5 per hundred thousand to 8 per hundred thousand. If this total has steadily increased, in 1970 the population of the U.S. was 203 million and 50,000 persons died from emphysema, how many people per hundred thousand died from emphysema? What predictions could be made for 1980?

E. Have the students take the information they have gathered in the class and outside activities and make up some problems.

1. Give the problems to other members of the class to work on.

ESEA Title III - 59-70-0135-2 Project I-C-E

CONCEPT 5. An adequate supply of clean air is essential because most organisms depend on oxygen, through respiration, to release the energy in their food.

Discipline Area Math

Subject Consumer Matt

Problem Orientation Resources

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERIEN	
Cognitive: Student will collect, present and interpret data regarding causal relationship between smoking and the death rate. Affective: Students will form opinions regarding the evidence involved with cigarette smoking. Skills to be Learned 1. Researching material 2. Graphing statistical facts 3. Using sampling techniques 4. Computing correlation 5. Determining mean, median, mode and standard deviation.	I. Student-Centered in class activity A. Read assigned material (see back publications) B. Graph the relationship between time in years and the number of smokers in the U.S. by a line graph. C. Graph, by use of a histogram, the percentage of smokers in the U.S. in relationship to every 10 years starting with the year 1900. D. The student shall determine the correlation between number of packs of cigarettes vs. the death rate. E. The student will, from their sample in II, find the mean, median, mode and standard deviation of the number of cigarettes per day of the smokers. F. Compute the cost for a person who smokes two packs of cigarettes a day at 50¢ a pack over a ten year period.	II. Outside Re Community A A. Develop determin cigarett day. 1. Deter sampl

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Discipline Area Math

Subject Consumer Math

Problem Orientation Resources Grade 11-12

SUGGESTED LEARNING EXPERIENCES

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e number of smokers in
e U.S. by a line graph.
aph, by use of a histo-
am, the percentage of
okers in the U.S. in
lationship to every 10
ars starting with the
ar 1900.
he student shall determine
he correlation between
umber of packs of cigarettes
. the death rate.
he student will, from
heir sample in II, find
he mean, median, mode and
tandard deviation of the
umber of cigarettes per
ay of the smokers.
ompute the cost for a person
ho smokes two packs of
igarettes a day at 50¢ a
ack over a ten year period.

II. Outside Resource and Community Activities

A. Develop a questionnaire that determines the number of cigarettes a person smokes a day.

1. Determine by using a random sample of 50 people.

Resource and Reference Materials	Continued and Additional Su
Publications: Smoking and Death Rates-A Riddle in Cause and Effect, by E. Cuyler Hammond Effect of Smoking, by E. Cuyler Hammond-W.H. Freeman and Co. Lung Cancer Death Rates in Relation to Smoking-American Cancer Society Chart Book in Smoking, Tobacco, Health, U.S. Dept. of Health, Education and Welfare The Health Consequence of Smoking, U.S. Dept. of Health, Education and Welfare Audio-Visual: #3485-"Let's Discuss Smoking-No Smoking," $3.25, 16 min., BAVI #5904-"No Smoking," Sid Davis, 10 min., $2.25, 1964, BAVI #6033-"Smoking and You," Color, $4.50, Contemporary, 1964, 11 min., BAVI #7538-"Smoking: It's Your Choice," color, 15 min., $6.00, 1970, Alfred Higgins, BAVI Community: City health official, doctor visits class	

inued and Additional Suggested Learning Experiences

CONCEPT 7. Factors such as facilitating transportation economic conditions, population growth, and increased leisure time have a great influence on changes in land use and centers of population density.

Discipline Area

Subject

Problem Orienta

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING E
Cognitive: The student will compile data and determine a proportionality constant for population growth. Affective: The student will develop an awareness of factors affecting population growth. Skills to be Learned 1. Data analysis 2. Exponential law 3. Geometric sequence 4. Prediction formulas	I. Student-Centered in class activity A. Compile population data for 1. Several countries 2. Several states 3. Several cities from 1900 through 1970 B. Graph data C. Find places of declining population and determine factors contributing to decline. D. Compare birth rates and death rates for U.S. for several years. E. Predict population for 1980 and 2000 using data from part A. 1. Use Malthas formula $x_{n\pm1} = q \cdot x_n$ where x_1 = population of first generation q = constant of proportionality or the ratio of the geometric sequence 2. Use Verhalst's formula $x_{n\pm1} = \frac{q}{1+ rx_n} \cdot x_n$ where x is a competition f (cont.)

II.

litating transportation	Discipline Area	Mathematics
ulation growth, and	Subject	Algebra II
ave a great influence	Problem Orientation	population growth — Grade 11
nd centers of		

	SUGGESTED LEARNING EXPERIENCES	
11	I. Student-Centered in class activity A. Compile population data for 1. Several countries 2. Several states 3. Several cities from 1900 through 1970 B. Graph data C. Find places of declining population and determine factors contributing to decline. D. Compare birth rates and death rates for U.S. for several years. E. Predict population for 1980 and 2000 using data from part A. 1. Use Malthas formula $x_{n+1} = q \cdot x_n$ where x_1 = population of first generation q = constant of proportionality or the ratio of the geometric sequence 2. Use Verhalst's formula $x_{n+1} = \frac{q}{1+rx_n} \cdot x_n$ where x is a competition factor (cont.)	II. Outside Resource and Community Activities A. Visit a computer center where population size or structure can be simulated by varying ecological factors.
11		
on		

Resource and Reference Materials	Continued and Additiona
Publications: Studies in Mathematics Volume X Applied Mathematics in High School by Max M. Schiffer SMSG Population Bulletin World Population Data Sheet People Population Reference Bureau 1755 Massachusetts Avenue N.W. Washington, D.C. 20036 ($3.00 per year) U.S. News and World Report March 6, 1972, P. 34 1971 E.Q. Index I-C-E RMC Plato System of Computer Parameters Paul Handler University of Illinois Urbana, Ill. 61801 1917 EQ Index National Wildlife Federation I-C-E RMC Audio-Visual: Community: Computer control center	I. (cont.) 3. Use a method of y develop a method the future. Comp Malthas and Verha

e Materials	Continued and Additional Suggested Learning Experiences
lume X gh et au N.W. t Parameters tion	I. (cont.) 3. Use a method of your own. The student will develop a method to determine population in the future. Compare your method to the Malthas and Verhalst formulas.

ESEA Title III - 59-70-0135-2 Project I-C-3

CONCEPT 8. Cultural, economic, social, and political factors determine status of man's values and attitudes toward his environment.

Discipline Area Math
Problem Solv
Subject Scientific N
Problem Orientation Sound Pol

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERIEN	II. Ou Com
Cognitive: Students will make a list of things in their community which contribute to sound pollution, both industrial and recreational. Affective: Students volunteer to measure the intensity of a variety of noises in the community: a factory, traffic, a dance with a live group furnishing music, snowmobile, etc.	I. Student-Centered in class activity A. Measure areas and intensity of noise. (A decimeter can be borrowed if not available.) B. Students should learn the definitions of some unfamiliar terms: 1. Intensity of sound 2. Threshold of hearing 10^{-16} watts/cm^2 3. Threshold of pain 4. Degree of loudness 5. Decibel C. Sample Problem: Taken from Modern Physics, Williams, Metcalfe, Lefler. 1. Sound energy is radiated uniformly in all directions from a small source at a rate of 1.2 Watts. a. What is the intensity of sound at a point (2500 cm) 25 meters from the source? b. What is the intensity level. (cont.)	A. B. C. D.
Skills to be Learned The formula for measuring intensity of sound. $I = \frac{P}{A}$ I=Watts per sq. cm. P=Sound power in Watts A=Area in sq. cms. Surface area of sphere = $4\pi r^2$ Work with scientific numbers Problems in logarithms Understand decibel as a unit of measure		

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Discipline Area Math

Subject Problem Solving - Logarithms
Scientific Numbers, Graphing

Problem Orientation Sound Pollution Grade 9,11,12

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity

A. Measure areas and intensity of noise. (A decimeter can be borrowed if not available.)

B. Students should learn the definitions of some unfamiliar terms:
   1. Intensity of sound
   2. Threshold of hearing
      10^{-16} watts/cm^2
   3. Threshold of pain
   4. Degree of loudness
   5. Decibel

C. Sample Problem: Taken from Modern Physics, Williams, Metcalfe, Lefler.
   1. Sound energy is radiated uniformly in all directions from a small source at a rate of 1.2 Watts.
      a. What is the intensity of sound at a point (2500 cm) 25 meters from the source?
      b. What is the intensity level.

(cont.)

II. Outside Resource and Community Activities

A. Check with factories and find out what problems they have with excessive noise. Ask what they have been able to do to control it.

B. Ask someone from the factory, foundry, etc., to explain the type of injury (permanent or temporary) which a person can sustain from excessive noise.

C. Check with someone from Workman's Compensation Ins., a doctor, etc., on the extent & seriousness of the problems of sound pollution.

D. Formulate a questionnaire and have the students use it with their neighbors to find out what kind of noises bother them most in the neighborhood.

Resource and Reference Materials

Publications:

U.S. News & World Report, Sept. 23, 1963, p. 64.
Science World, Feb. 9, 1970, p. 8.
Milwaukee Journal, June 29, 1971.
Health, Winter 1970, p. 20.
Our Sunday Visitor, Mar. 21, 1971, Decibel Dynamite.
Changing Times, March 1971, p. 33.
Sunday Post Crescent (Appleton, Wi.) Nov. 8, 1970, page E-3.
Newsweek, Feb. 7, 1972.
Science Digest, June 1968, pp. 67-8.
Time, Aug. 9, 1968, p. 47.
Science Digest, Oct. 1968, pp. 63-4.

Audio-Visual:

Visual Education Consultants, Inc. Noise Pollution, filmstrip #3013

From NET, Indiana University AV Center, Bloomington, Ind. 47401
Noise: The New Pollutant (30 min. film), rental $6.75.

Community:

Continued and Additional Suggested Le

I. (cont.)

2. Solutions:

a. $I=\frac{P}{A} = \frac{1.2W}{4\pi(2500)^2} = \frac{1.2}{7.85x}$

b. $10 \log \frac{I}{I} = 10 \log \frac{15x10^{-}}{10^{-1}}$

D. Teacher-student discussion.

1. Encourage students to have h
2. Encourage students to keep t of noise pollution.
3. Press for laws which control
4. Continue to be conscious of t pollution on "quality of life students to avoid needlessly pollution in the community.
5. Keep students aware of injury permanent) to their ears. Los due to excessive noise is rea
6. Find a table of intensity lev sounds. Compare these sounds.

Continued and Additional Suggested Learning Experiences

I. (cont.)

2. Solutions:

a. $I=\frac{P}{A} = \frac{1.2W}{4\pi(2500)^2} = \frac{1.2}{7.85\times10^8} = 1.5\times10^{-8}\ w/cm^2$

b. $10 \log \frac{I}{I} = 10 \log \frac{15\times10^{-8}}{10^{-16}} = 10 \log(1.5\times10^8)$

$= 82$ decibels

D. Teacher-student discussion.

1. Encourage students to have hearing examinations.
2. Encourage students to keep the community aware of noise pollution.
3. Press for laws which control noise pollution.
4. Continue to be conscious of the effect of noise pollution on "quality of life" and encourage students to avoid needlessly adding to noise pollution in the community.
5. Keep students aware of injury (probably permanent) to their ears. Loss of hearing due to excessive noise is real.
6. Find a table of intensity levels of various sounds. Compare these sounds.

CONCEPT

9. Man has the ability to manage, manipulate, and change his environment.

Discipline Area Math

Subject Advan

Problem Orientation Bal

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING
Cognitive: The student will set up an equation showing the benefits and disadvantages of each given topic and balance the facts & create a positive action. Affective: The student will evaluate projects comparing short term advantages to long term disadvantages. Skills to be Learned 1. Balancing 2. Creating off setting forces with little or no complications.	I. Student-Centered in class activity A. Research and list alternating environmental change. (Examine good and bad effects) 1. Build dams & reservoirs 2. Kill mosquitos & insects 3. Dredge channels 4. Project Sanquine 5. Melt Polar caps 6. Super Sonic aircraft 7. Space probes 8. Subterranean mining 9. Strip mining 10. Convert salt H_2O 11. Rain making 12. Landfill reclamation.

ESEA Title III - 59-70-0135-2 Project I-C-E

age,

Discipline Area Math

Subject Advanced Algebra

Problem Orientation Balancing Equations Grade 11

SUGGESTED LEARNING EXPERIENCES

Student-Centered in class activity

A. Research and list alternating environmental change. (Examine good and bad effects)
   1. Build dams & reservoirs
   2. Kill mosquitos & insects
   3. Dredge channels
   4. Project Sanquine
   5. Melt Polar caps
   6. Super Sonic aircraft
   7. Space probes
   8. Subterranean mining
   9. Strip mining
   10. Convert salt H_2O
   11. Rain making
   12. Landfill reclamation.

II. Outside Resource and Community Activities

A. Visit a museum to see an ant farm or a honey farm at work.

B. Class speaker - have a "conservationist" explain the unexpected complications and disadvantages of I. (1,2,4,9,etc.)

C. Look at the effect of the "Vietnam Conflict" on the vegetation and soil.

RESOURCE AND REFERENCE MATERIALS	Continued and Additional Suggest
Publications: 160WA Man and His Environment I-C-E RMC 100BU Daydreams and Nightmares I-C-E RMC Newspapers Audio-Visual: BAVI 2996 - Man's Impact on His Environment - Color $7.50 - 22 minutes - 1969. 1595 - Our Earth - $2.00 - 11 minutes - 1937 Community: County Conservation Officer Another classroom (science) or museum Library	

ERIALS	Continued and Additional Suggested Learning Experiences
ent ares	

ESEA Title III - 59-70-0135-2 Project I-C-2

CONCEPT 11. Individual acts, duplicated or compounded, produce significant environmental alterations over time.

Discipline Area Math

Subject Consumer M

Problem Orientation Mass Tran

BEHAVIORAL OBJECTIVES	SUGGESTED LEARNING EXPERI	II. Ou Com
Cognitive: The student will compare the advantages and disadvantages of mass transportation of all types and determine which method will save natural resources, yet, be convenient. Affective: The student will realize that we must sacrifice some conveniences to save our own environment. Skills to be Learned Data collecting Comparisons (rational)	I. Student-Centered in class activity A. Research and discuss the extra cost in loss of natural resources of individual transportation as opposed to mass transportation. B. Facts given: 1. Cars amount for 67% of traffic but carry only 15% of the passengers. 2. One passenger train can carry traffic equal to 20 traffic express lanes. Teacher uses these facts to illustrate problem-solving methods in assessing the advantages and disadvantages of transportation. Teacher assigns small groups of students to calculate the costs and impact (advantages and disadvantages) of varied methods of transportation: automobile, buses, rail, monorail, elevated train, helicopter, light plane, (cont.)	A. B.

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Discipline Area Math

Subject Consumer Math

Problem Orientation Mass Transportation Grade 10-12

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity
   A. Research and discuss the extra cost in loss of natural resources of individual transportation as opposed to mass transportation.
   B. Facts given:
      1. Cars amount for 67% of traffic but carry only 15% of the passengers.
      2. One passenger train can carry traffic equal to 20 traffic express lanes.

   Teacher uses these facts to illustrate problem-solving methods in assessing the advantages and disadvantages of transportation. Teacher assigns small groups of students to calculate the costs and impact (advantages and disadvantages) of varied methods of transportation: automobile, buses, rail, monorail, elevated train, helicopter, light plane,
(cont.)

II. Outside Resource and Community Activities
   A. Survey the number of empty seats in cars while traveling along a highway.
      1. The student will have to judge the carrying capacity of each car.
      2. After judging the capacity, how many empty seats were in each car?
      3. Total #1 & #2 and tabulate the results.
      4. Project this to a national average.
   B. Conduct a litter count.
      1. Determine cost of man hours to restore the area to its original condition.
      2. Extend this cost to the area of your city or state on an annual basis.

Resource and Reference Materials	Continued and Additional Suggested Lea
Publications:	I. (cont.) airplane, Saturn V. C. Determine the loss of earth's su cars of the metropolis.
Audio-Visual:	
Community:	

erials	Continued and Additional Suggested Learning Experiences
	I. (cont.) airplane, Saturn V. C. Determine the loss of earth's surface area to park cars of the metropolis.

PROJECT I-C-E Episode Evaluation Form (Reproduce or

Please fill in:
Subject: _____

Grade: _____

Concept No. Used: _____

In commenting on each episode use
form. Feel free to adapt it and a
your critiques and comments - negat
hand column, please rate (poor, goo
make specific comments or suggestio
vided to help us make this a more u

Poor	Good	Exc.	
			I. Behavioral Objectives A. Cognitive:
			B. Affective:
			II. Skills Developed
			III. Suggested Learning Experiences A. In Class:
			B. Outside & Community Activities:
			IV. Suggested Resource & Reference Materials (specific suggestions & comments)

CT I-C-E Episode Evaluation Form (Reproduce or duplicate as needed)

____	In commenting on each episode used in your class, please use this form. Feel free to adapt it and add more pages. Let us know all your critiques and comments - negative and positive. In the left-hand column, please rate (poor, good, excellent) each item. Also, make specific comments or suggestions if possible in the space provided to help us make this a more usable guide. Thank you.
____	
____	

I. Behavioral Objectives
A. Cognitive:

B. Affective:

II. Skills Developed

III. Suggested Learning Experiences
A. In Class:

B. Outside & Community Activities:

IV. Suggested Resource & Reference Materials
(specific suggestions & comments)

Project I-C-E
Serving Schools in CESA 3-8-9
1927 Main Street
Green Bay, WI 54301